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09/833,016	04/10/2001	Shilin Chen	SC-98-25A	1340

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EXAMINER

JONES, HUGH M

ART UNIT	PAPER NUMBER
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2128

DATE MAILED: 03/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/833,016

Applicant(s)

Chen

Examiner

Hugh Jones

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Aug 25, 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 34-50 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 34-50 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on Apr 10, 2001 is/are a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 12, 1 6) ☐ Other:

Requirement for Information - 37 C.F.R. § 1.105

1. Applicant and the assignee of this application are required under 37 CFR 1.105 to provide the following information that the examiner has determined is reasonably necessary to the examination of this application:

2. In response to this requirement, please provide a copy of each of the following items of art referred to in the specification:

- The Specification (lines 7-15, page 23) *incorporates* the following documents which the Examiner has determined is reasonably necessary for examination of the application:

- ***Applied Drilling***: Bourgoyne et al.;
- ***Oil and Gas Field Development Techniques: Drilling***: Nguyen;
- ***Making Hole***: Kirkley;
- ***Drilling mud***: Kirkley.

- The Specification also *refers to* the following documents which the Examiner has determined is reasonably necessary for examination of the application:

- ***Wave Propagation in Petroleum Engineering***: Chin;
- ***Experimental Evaluations of Drill String Dynamics***: Dykstra et al.
- ***Penetration Problems in Rock Mechanics***: Sikarskie et al.

3. In response to this requirement, please provide any information about related litigation.

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4. The fee and certification requirements of 37 CFR 1.97 are waived for those documents submitted in reply to this requirement. This waiver extends only to those documents within the scope of this requirement under 37 CFR 1.105 that are included in the applicant's first complete communication responding to this requirement. Any supplemental replies subsequent to the first communication responding to this requirement and any information disclosures beyond the scope of this requirement under 37 CFR 1.105 are subject to the fee and certification requirements of 37 CFR 1.97.

5. The applicant is reminded that the reply to this requirement must be made with candor and good faith under 37 CFR 1.56. Where the applicant does not have or cannot readily obtain an item of required information, a statement that the item is unknown or cannot be readily obtained will be accepted as a complete reply to the requirement for that item.

6. This requirement is an attachment of the enclosed Office action. A complete reply to the enclosed Office action must include a complete reply to this requirement. The time period for reply to this requirement coincides with the time period for reply to the enclosed Office action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Hugh Jones whose telephone number is (703) 305-0023. The examiner can normally be reached on Monday through Thursday.

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8. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on (703) 305-9704. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

9. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-3900.

Hugh Jones

Primary Patent Examiner

December 23, 2003



KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER



HUGH JONES Ph.D.
PRIMARY PATENT EXAMINER
TECHNOLOGY CENTER 2100

DETAILED ACTION

Introduction

1. **Claims 34-50 of U. S. Application 09/833,016, filed on April 10, 2001 are presented for examination.**

Interference

2. **Applicant have cancelled all earlier versions of claims and requested that Examiner declare an Interference (paper # 17) against U. S. Application 09/635,116.** Claims 34-36, 40, 46-50 of this application are alleged by applicant to correspond to claims 1, 5, 10, 16, 22-26 of U.S. Patent No. 09/635,116.

3. Before an Interference can be declared, the Examiner must determine that there is interfering subject matter claimed in the application (against the copied claims) which is patentable to the applicant subject to a judgment in the interference. The interfering subject matter will be defined by one or more counts. The application must contain, or be amended to contain, at least one claim that is patentable over the prior art and corresponds to each count. The claim in the application need not be, and most often will not be, identical to a claim in the patent. All claims in the application and patent which define the same patentable invention as a count shall be designated to correspond to the count.

4. Claims 34-36, 40, 46-50 of this application have been copied by the applicant from U. S. Application 09/635,116. These claims are not patentable to the applicant because of the claim rejections, subsequently presented.

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5. An interference cannot be initiated since prerequisite for interference under 37 CFR 1.606 is that the claim be patentable to the applicant subject to a judgement in the interference.

Information Disclosure Statement

6. The listing of references in the specification (lines 7-15, page 23, lines 18-21, page 2, line 23, page 6 to line 2, page 8, lines 17-19, page 8) is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

7. Please provide a copy of each of the following items of art referred to in the specification:

- The Specification (lines 7-15, page 23) *incorporates* the following documents which the Examiner has determined is reasonably necessary for examination of the application:

- *Applied Drilling*: Bourgoyne et al.;
- *Oil and Gas Field Development Techniques: Drilling*: Nguyen;
- *Making Hole*: Kirkley;
- *Drilling mud*: Kirkley.

- The Specification also *refers* (lines 18-21, page 2, line 23, page 6 to line 2, page 8, lines 17-19, page 8) to the following documents which the Examiner has determined is reasonably necessary for examination of the application:

- *Wave Propagation in Petroleum Engineering*: Chin;
- *Experimental Evaluations of Drill String Dynamics*: Dykstra et al.
- *Penetration Problems in Rock Mechanics*: Sikarskie et al.

Drawings

8. **Figures 10-12 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated.** See MPEP § 608.02(g). Figure 10 discloses a prior art drill rig; figure 11 discloses a prior art roller cone bit; figure 12 discloses a prior art drag bit. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

9. **The numbering of the dependent claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution.** When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

10. The dependent claims 37-39, 41-45 (see paper # 17) are dependent on cancelled claims (claims 16, 17, 18, 20, 20, 20, 15, 15, respectively). It is assumed that claims 37-39, 41-45

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depend on claims 36, 34, 34, 40, 40, 40, 35, 35, respectively. Clarification/correction is requested.

11. Claim 35 is objected to because of the following informalities. Claim 35 recites, in part (last limitation), "... incrementally rotating and combining the volume simulating until a difference..." This phrase actually indicates that the volume is rotated – it is assumed that it is the bit that is rotated (thus generating the volume). Therefore, the phrase should recite "incrementally rotating the bit, generating a volume, and combining the volume until..." or similar phraseology.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

12. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

13. **Claims 34-40 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.** The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

- The specification does not disclose substantial detail relating to the simulation or optimization other than to define variables which are to be simulated and optimized.

The specification refers to two papers by Ma (lines 2-14, page 7, specification) which do

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disclose such essential details; however, the Ma papers were not incorporated by reference and thus do not cure the deficiency.

- Pages 21-22 of the specification also mention six possible embodiments but provide no substantial detail other than a mere listing of steps. It is also noted that the “means for” language in the specification (line 16, page 22 – “performing an *optimization means*”) appears to be an improper attempt at incorporation by reference.

14. **Claims 34-35, 38-39, 44-45, 50 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for calculating the volume of a crater, does not reasonably provide enablement for calculating any other crater parameter.** The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims. The dependent claims inherit the defect.

15. **Claims 34-50 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a bit with three roller cones, does not reasonably provide enablement for a bit with any other number of roller cones.** The amendment to the specification (amendment to pages 21-22 – see paper # 17) appears to indicate that the range (for axial force distribution between rollers, for example) is between 31-35 %. The total percent can only be 100%. At most two rollers could only account for $2 \times 35\% = 70\%$, which is not possible; four rollers would account for, at minimum, $4 \times 31\% = 124\%$, which is also not possible. On the other hand $3 \times 33 \frac{1}{3}\% = 100\%$, which would make sense. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make

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and/or use the invention commensurate in scope with these claims. The dependent claims inherit the defect.

16. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

17. **Claims 35, 40-45 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.** The last limitation of the independent claims are ambiguous and are not understood. The dependent claims inherit the defect.

- For example, the last limitation of claim 35 recites:

*“adjusting at least one of the bit design parameters, and repeating the calculating the crater volume, incrementally rotating and combining the volume simulating **until a difference between the combined volume cut by each of the cones is less than the combined volume determined prior to the adjusting the at least one of the bit design parameters.**”*

The meaning of the italicized portion is unclear and the specification does not aid in understanding the phrase. The same issue occurs in claim 40 and dependent claims 41-45 which inherit the defect.

18. **Claims 34-50 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps.** See MPEP § 2172.01. The omitted steps relating to simulation/calculating are:

- Claims 34, 38-39: the steps pertaining to obtaining the volume;
- Claims 35, 44-45: the steps pertaining to balancing the volume

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The volume and its balancing are central to Applicant's invention. However, the essential steps in obtaining the volume or balancing of the volume are not claimed.

- Claims 36-37: the steps pertaining to obtaining the axial force
- Claims 40-43: the steps pertaining to obtaining the axial force balance

The axial force aspect is central to Applicant's invention. However, the essential steps in obtaining the axial force or balancing of the axial force are not claimed.

- Claims 46-49: the steps pertaining to the simulation.

The simulation is central to Applicant's invention. However, the essential steps in the simulation are not claimed.

- Claims 46-50: the steps pertaining to the optimization.

Optimization is also central to Applicant's invention. However, the necessary and essential details relating to how the optimization is achieved are not claimed. Furthermore, the *criterion* for the optimization has not been claimed – thus rendering the claims indefinite.

Applicants are reminded that the claims do not invoke 112(6) paragraph (“means for” or “step for”). This follows from analysis of the claims and from Applicant's statement in the specification (lines 16-22, page 23):

“None of the description in the present application should be read as implying that any particular element, step, or function is an essential element which must be included in the claim scope: THE SCOPE OF PATENTED SUBJECT MATTER IS DEFINED ONLY BY THE ALLOWED CLAIMS. Moreover, none of these

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claims are intended to invoke paragraph six of 35 USC section 112 unless the exact words "means for" are followed by a participle."

19. The term "substantially" in claims 48-49 is a relative term which renders the claim indefinite. The term "substantially" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is noted that the amendment to the specification (amendment to pages 21-22 – see paper # 17) appears to indicate that the range corresponding to "substantially" is between 31-35 %; however, this does not resolve the issue for the following reasons. The total percent can only be 100%. So if the percent on each of three bits is 35%, for example, the total would be 105%, which is not possible. If the percent is 31% on each of three bits, then the total would be 93%, which is not possible.

Double Patenting

20. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

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21. A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

22. Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

23. Claim 34-50 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-12 of U.S. Patent No. 6,213,225 (Chen) in view of Applicant's Own Admission (Applicant's website "Energy Balanced Series Roller Cone Bits").

24. Consider patented claim 6, for example:

A method of designing a roller cone drill bit, comprising the steps of:

(a) calculating the volume of formation of formation cut by each tooth on each cutting structure;

(b) calculating the volume of formation cut by each cutting structure per revolution of the drill bit;

(c) comparing the volume of formation cut by each of said cutting structures with the volume of formation cut by all others of said cutting structures of the bit;

(d) adjusting at least one geometric parameter on the design of at least one cutting structure; and

(e) repeating steps (a) through (d) until substantially the same volume of formation is cut by each of said cutting structures of said bit.

Compare to pending claim 49:

A method for optimizing a design of a roller cone drill bit, comprising:

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simulating the bit drilling through a selected earth formation;
adjusting at least one design parameter of the bit;
repeating the simulating of the bit drilling;
and
repeating the adjusting and simulating until a volume of formation cut by the bit is substantially balanced between the roller cones.

25. Although the conflicting claims are not identical, they are not patentably distinct from each other for the following reasons. The specifications are identical (the instant application is a continuation of the patent). The calculating and simulating appear to be functional equivalents, in the context of the claims. The patented claim does not recite the word "optimizing". It would have been obvious to one of ordinary skill in the art at the time of the invention that "optimizing" in pending claim 49 refers to

"... until a volume of formation cut by the bit is substantially balanced between the roller cones."

which is functionally equivalent to the feature in patented claim 6 wherein "... until substantially the same volume of formation is cut by each of said cutting structures of said bit."

Furthermore, Applicant's have admitted (Applicant's website "Energy Balanced Series Roller Cone Bits") the following:

"Dynamically balanced cutting structure (U. S. Patent 6,213,225 & 6,412,577) enables each cone to remove an equal volume of rock (volume balanced). It also equalizes the forces applied to each of the bit's three cones (force balanced). The result is near balance condition of the three cones."

26. Claim 34-50 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-6 of U. S.

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Patent 6,412,577 (Chen) in view of Applicant's Own Admission (Applicant's website "Energy Balanced Series Roller Cone Bits").

27. Consider patented claim 1, for example:

A method of designing a roller cone bit, comprising the steps of:
inputting initial bit geometry, rock properties, and bit operational parameters;
stepping through a sequence of time intervals and, at each of said time intervals,
mapping the locations of teeth which are cutting at a given time, and
calculating cutting area, volume and forces for each of said teeth which is cutting at said given time, using the results of said mapping step;
adjusting the orientation of said teeth, in accordance with the results of said calculating step.

Compare to pending claim 49:

A method for optimizing a design of a roller cone drill bit, comprising:
simulating the bit drilling through a selected earth formation;
adjusting at least one design parameter of the bit;
repeating the simulating of the bit drilling;
and
repeating the adjusting and simulating until a volume of formation cut by the bit is substantially balanced between the roller cones.

28. Although the conflicting claims are not identical, they are not patentably distinct from each other for the following reasons. The calculating and simulating appear to be functional equivalents, in the context of the claims. The patented claim does not recite the word "optimizing". However, the patented claim does recite adjusting the design (i.e., orientation of the teeth) in response to the calculating of the cutting area, volume and forces. It would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the

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orientation of the teeth so that an optimal design is obtained because it would seem unlikely that an adjustment would be made to a design to obtain a less than optimal design. Furthermore, Applicant's have admitted (Applicant's website "Energy Balanced Series Roller Cone Bits") the following:

"Dynamically balanced cutting structure (U. S. Patent 6,213,225 & 6,412,577) enables each cone to remove an equal volume of rock (volume balanced). It also equalizes the forces applied to each of the bit's three cones (force balanced). The result is near balance condition of the three cones."

29. A recitation of the intended use of the claimed invention (i.e., "optimizing") must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963).

30. Furthermore, Applicants have stated in the specification (lines 16-22, page 23):

"None of the description in the present application should be read as implying that any particular element, step, or function is an essential element which must be included in the claim scope: THE SCOPE OF PATENTED SUBJECT MATTER IS DEFINED ONLY BY THE ALLOWED CLAIMS. Moreover, none of these claims are intended to invoke paragraph six of 35 USC section 112 unless the exact words "means for" are followed by a participle."

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However, although limitations from the specification are not read into the claims, the claims are interpreted in light of the specification. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Claim Interpretation

31. The subsequent prior art rejections are asserted in view of the following claim analysis.

32. The claims do not invoke 112(6) paragraph ("means for" or "step for"). This follows from analysis of the claims and from Applicant's statement in the specification (lines 16-22, page 23):

"None of the description in the present application should be read as implying that any particular element, step, or function is an essential element which must be included in the claim scope: THE SCOPE OF PATENTED SUBJECT MATTER IS DEFINED ONLY BY THE ALLOWED CLAIMS. Moreover, none of these claims are intended to invoke paragraph six of 35 USC section 112 unless the exact words "means for" are followed by a participle."

33. Numerous 112 rejections have been applied against the claims. MPEP section

2143.03 addresses the issue of applying prior art against such claims:

A claim limitation which is considered indefinite cannot be disregarded. If a claim is subject to more than one interpretation, at least one of which would render the claim unpatentable over the prior art, the examiner should reject the claim as indefinite under 35 U.S.C. 112, second paragraph (see MPEP § 706.03(d)) and should reject the claim over the prior art based on the interpretation of the claim that renders the prior art applicable. Ex parte Ionescu, 222 USPQ 537 (Bd. Pat. App. & Inter. 1984) (Claims on appeal were rejected on indefiniteness grounds only; the rejection was reversed and the case remanded to the

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examiner for consideration of pertinent prior art.). Compare *In re Wilson*, 424 F.2d 1382, 165 USPQ 494 (CCPA 1970) (if no reasonably definite meaning can be ascribed to certain claim language, the claim is indefinite, not obvious) and *In re Steele*, 305 F.2d 859, 134 USPQ 292 (CCPA 1962) (it is improper to rely on speculative assumptions regarding the meaning of a claim and then base a rejection under 35 U.S.C. 103 on these assumptions).

See also section 2173.06 (Prior Art Rejection of Claim Rejected as Indefinite):

All words in a claim must be considered in judging the patentability of a claim against the prior art. In *re Wilson*, 424 F.2d 1382, 165 USPQ 494 (CCPA 1970). The fact that terms may be indefinite does not make the claim obvious over the prior art. When the terms of a claim are considered to be indefinite, at least two approaches to the examination of an indefinite claim relative to the prior art are possible. First, where the degree of uncertainty is not great, and where the claim is subject to more than one interpretation and at least one interpretation would render the claim unpatentable over the prior art, an appropriate course of action would be for the examiner to enter two rejections: (A) a rejection based on indefiniteness under 35 U.S.C. 112, second paragraph; and (B) a rejection over the prior art based on the interpretation of the claims which renders the prior art applicable. See, e.g., *Ex parte Ionescu*, 222 USPQ 537 (Bd. App. 1984). When making a rejection over prior art in these circumstances, it is important for the examiner to point out how the claim is being interpreted. ***Second, where there is a great deal of confusion and uncertainty as to the proper interpretation of the limitations of a claim, it would not be proper to reject such a claim on the basis of prior art.*** As stated in *In re Steele*, 305 F.2d 859, 134 USPQ 292 (CCPA 1962), a rejection under 35 U.S.C. 103 should not be based on considerable speculation about the meaning of terms employed in a claim or assumptions that must be made as to the scope of the claims. The first approach is recommended from an examination standpoint because it avoids piecemeal examination in the event that the examiner's 35 U.S.C. 112, second paragraph rejection is not affirmed, and may give applicant a better appreciation for relevant prior art if the claims are redrafted to avoid the 35 U.S.C. 112, second paragraph rejection.

34. There is a great deal of confusion and uncertainty *as to the proper interpretation of the limitations of claims 35, 40-45 in particular, and thus it would not be proper to reject such a*

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claim on the basis of prior art. However, in the interests of compact prosecution, such an interpretation will be nonetheless provided. The meaning of the last limitation of claims 35 and 40 is unknown. However, a careful study of the specification indicates that Applicants regard as essential to the claimed invention balancing the bit rollers with respect to energy, force and volume removed from the earth. Therefore, it is assumed that the last limitation of claim 35 is referring to removing "substantial" equal volumes of earth and that the last limitation of claim 40 is referring to "substantially" balancing the axial forces between the roller cones.

Claim Rejections - 35 USC § 102

35. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

36. **Claims 34, 36-39, 46, 50 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Ma et al. (The Computer Simulation of the Interaction Between Roller Bit and Rock – 1995 – of record) or Ma ("The operational mechanics of the rock bit" – 1996 - of record).**

37. Ma et al. ("The computer simulation of the interaction between roller bit and rock" – 1995 – of record) discloses:

optimal roller bit design using computer simulation (entire paper);

operational mechanics of the roller bit geometry ("The model of bit and bottom"; "roller bit"; "bottom hole");

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kinematics of the bit (“The model of bit and bottom”; rotation angle of cone”; “The simulation of interaction”);

rock-bit interaction and crater analysis (“crater model”; “Interaction between bit and rock”);

bit design including force analysis (“The simulation of Interaction”).

38. Ma (“The operational mechanics of the rock bit” – 1996 - *of record*)

discloses:

optimal roller bit design using computer simulation (chapter 6) based on the entire teachings in the book, including

operational mechanics of the roller bit geometry (details in chapter 2);

kinematics of the bit (details in chapter 3);

rock-bit interaction (details in chapter 5); and

bit design including force analysis (see page 232: “evaluate the size, load, motion, stress, and strain of each part...”).

Claim Rejections - 35 USC § 103

39. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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40. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

41. **Claims 35, 40-45, 47-49 are rejected under 35 U.S.C. § 103(a) as being unpatentable over [Ma et al. (“The computer simulation of the interaction between roller bit and rock” – 1995 – *of record*) or Ma (“The operational mechanics of the rock bit” – 1996 - *of record*)] in view of [Warren et al.] and in further view of [Applicant’s Own Admission].**

42. Ma et al. (“The computer simulation of the interaction between roller bit and rock” – 1995 – *of record*) discloses:

optimal roller bit design using computer simulation (entire paper);

operational mechanics of the roller bit geometry (“The model of bit and bottom”; “roller bit”; “bottom hole”);

kinematics of the bit (“The model of bit and bottom”; rotation angle of cone”; “The simulation of interaction”);

rock-bit interaction and crater analysis (“crater model”; “Interaction between bit and rock”);

bit design including force analysis (“The simulation of Interaction”).

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43. Ma ("The operational mechanics of the rock bit" – 1996 - *of record*)

discloses:

optimal roller bit design using computer simulation (chapter 6) based on the entire teachings in the book, including

operational mechanics of the roller bit geometry (details in chapter 2);

kinematics of the bit (details in chapter 3);

rock-bit interaction (details in chapter 5); and

bit design including force analysis (see page 232: "evaluate the size, load, motion, stress, and strain of each part...").

44. **Ma et al. (1995) or Ma et al. (1996) do teach optimal design but do not *expressly* teach that the optimal design consists of**

- balancing the volume cut over the three rollers (claims 35, 49, for example);
- balancing the forces over the three rollers (claims 40-45, for example);
- maximizing the drill rate (claim 47, for example)

45. It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the teachings of Ma et al. to consider as optimal design such a design wherein the forces and volumes are balanced among rollers and further to maximize the drill rate for the following reasons. It was well known in the art at the time of the invention to those of ordinary skill in the art that a pervasive problem in the industry was that of unbalanced forces on bits resulting in drill bit whirl further resulting in a decrease of drill penetration rate.

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46. Warren et al. disclose *teach that the issues relating to bit imbalance were well known and studied in the prior art for at least the last decade*. Warren et al. further teach the dependence of drill penetration rate on relative force balance.

In particular, note col. 1, line 28 to col. 2, line 21:

"Numerous studies have been made to find out what causes such destruction to the cutting elements. The inventors hereof have previously found that a substantial portion of the destructive forces are generated by radial imbalance forces that cause a drill bit to rotate about a rotational axis offset from the geometric center of the drill bit in such a way that the drill bit tends to wobble or "backwards whirl" about the borehole. This backwards whirling causes the center of rotation to change dramatically as the drill bit rotates about the borehole. Thus, the cutting elements travel faster, sideways, and backwards and thus are subject to greatly increased impact loads which cause the destruction of the cutting elements.

More specifically, circumferential drilling imbalance forces exist to some degree on every drill bit and these forces tend to push the drill bit towards the side of the borehole. In a typical drill bit, gauge cutting elements are designed to cut the edge of the borehole. During the cutting process, the effective friction between the cutting elements near the gauge area increase and, thus, the instantaneous center of rotation becomes some point other than the geometric center of the drill bit. When this happens, the usual result is for the drill bit to begin to backwards whirl around the borehole. This whirling process regenerates itself because sufficient friction is always generated between the drill bit gauge area and the borehole wall, no matter what the orientation of the drill bit, from the centrifugal forces generated by the rapid acceleration of the drill bit.

Various methods and equipment have been proposed to eliminate or reduce these imbalance forces, including using dynamically balanced lower drill string assemblies and very precisely aligning the cutting elements to reduce imbalance forces.

Various designs of drill bits have been developed to improve penetration rates by aligning the cutting elements in a plurality of equal radius sets, with each set being in overlapping radial relationship. One such drill bit design is disclosed in U.S. Pat. No. 4,545,441. Further, various attempts at improving cutting element life have been made by varying the back or side rake or angle of attack of the cutting elements, i.e., the angle at which the face of the cutting element addresses the formation with respect to the formation surface. The benefits of varying such back rake angles are disclosed in "The Effect Of Back Rake On The Performance Of Small-Diameter Polycrystalline Diamond Rock Bits: ANOVA Tests," Journal of Energy Resources Technology, Vol. 108, No. 4, pp. 305-309, December 1986; U.S.

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Pat. No. 4,660,659; U.S. Pat. No. 4,440,247; U.S. Pat. No. 4,186,628 and U.S.S.R. Pat. No. 395,559. The effects of varying side rake angles is disclosed in Hunnj SPE-10152 (1981).

There is no disclosure or suggestion in any of the above-identified article or patents of arranging cutting elements specifically to prevent or reduce the effects of destructive bit whirl. *There is a need for a drill bit design which incorporates features designed specifically for preventing bit whirl and improving cutting element life.*"

Thus, It would have been obvious to one of ordinary skill in the art at the time of the invention was to modify the teachings of Ma et al. to consider as optimal design such a design wherein the forces and volumes are balanced among rollers.

47. It would have further been obvious to one of ordinary skill in the art at the time of the invention was made that if the Ma et al. teachings incorporated an optimal condition wherein the forces were balanced among rollers; that it would have been further obvious to one of ordinary skill in the art at the time of the invention to further modify the Ma et al. teachings to balance the volume of earth cut among the rollers. There is a direct and inherent (as well as obvious) relationship between energy, drill rate, applied force and resultant removed volume of formation. This follows from Newton's laws of motion. This inherent relationship has also been recognized by Applicants when they admit (lines 4-11, page 20, specification) that:

"The geometric parameters of the roller cone bit are then modified such that the volume of formation removed by each cutting structure is equalized. Since the amount of formation removed by a cutting structure is a function of the force imparted on the formation by the tooth, the volume of formation removed by a cutting structure is a direct function of the force applied to the cutting structure. By balancing the volume of formation removed by all cutting structures, force balancing is also achieved."

Response to Arguments

48. Applicant's arguments filed 6/27/2001 (paper # 4), 10/08/2002 (paper # 7), 2/14/2003 (paper # 11), 4/21/2003 (paper # 14), 5/25/2003 (paper # 15), 8/25/2003 (paper # 17), 6/2/2003 (paper # 20) have been fully considered but they are moot in view of the new grounds of rejection.

49. Note that paper # 20 (6/2/2003) has been entered. However, the Examiner assumes that paper # 17 (8/25/2003) contains the correct listing of claims. Paper # 20 (6/2/2003) cancelled claims 1-16 and entered claims 17-33. Claims 1-33 were cancelled (note that only *claims 17-33 could have been cancelled since claims 1-16 were cancelled in paper # 20 6/2/2003*) and claims 34-50 were entered by Supplemental amendment D (paper # 15, 8/25/2003). The Request for Interference (paper # 17 – 8/25/2003) duplicates the amendments made in paper # 15 (8/25/2003) and also includes a proposed Count for purposes of Interference as well as Applicant's position on correspondence between the claims of the alleged interfering application and the claims of the instant application.

50. Applicant have cancelled all earlier versions of claims and requested that Examiner declare an Interference (paper # 17) against U. S. Application 09/635,116. Claims 34-36, 40, 46-50 of this application are alleged by applicant to correspond to claims 1, 5, 10, 16, 22-26 of U.S. Patent No. 09/635,116.

51. Before an Interference can be declared, the Examiner must determine that there is interfering subject matter claimed in the application (against the copied claims) which is patentable to the applicant subject to a judgment in the interference. The interfering subject

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matter will be defined by one or more counts. The application must contain, or be amended to contain, at least one claim that is patentable over the prior art and corresponds to each count. The claim in the application need not be, and most often will not be, identical to a claim in the patent. All claims in the application and patent which define the same patentable invention as a count shall be designated to correspond to the count.

52. Claims 34-36, 40, 46-50 of this application have been copied by the applicant from U. S. Application 09/635,116. These claims are not patentable to the applicant because of the claim rejections, presented earlier.

53. An interference cannot be initiated since a prerequisite for interference under 37 CFR 1.606 is that the claim be patentable to the applicant subject to a judgement in the interference.

Conclusion – Prior Art Made of Record

54. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following are considered cumulative to the applied prior art and therefore have not been applied in prior art rejections:

- Ma et al. ("Dynamics of roller cone bits" – 1985 – *of record*).
- Ma et al. ("Kinematics of the cone bit" – 1985 – *of record*).
- Brett et al. (U. S. Patent 5,042,596) discloses an imbalance compensated drill bit that *takes advantage of undesired and destructive imbalance forces to prevent bit whirl*. Methods of designing and making such imbalance compensated drill bits are disclosed whereby a drill bit body has at least one cutting zone with a plurality of cutting elements extending therefrom and at

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least one bearing zone. The bearing zone has a relatively smooth surface and is located at a position where the net imbalance force (from the cutting elements) is directed towards. When the drill bit is rotated, the imbalance force presses the bearing zone against the borehole wall, and the bearing zone slips along the wall, thereby preventing the center of rotation to shift and create the destructive whirling motion. *Brett et al. teach that the issues relating to bit imbalance were well known and studied in the prior art for at least the last decade.*

Brett et al. (U. S. Patent 5,131,478) disclose that the issues relating to bit imbalance were well known and studied in the prior art for at least the last decade. *See figure 17, in particular.*

Chen ("Linear and nonlinear dynamics of drill strings" – PH. D. Thesis of inventor –1995 – *of record*) discloses bit whirl kinematics (caused by force imbalance) and its analysis (chapter 5, in particular – note page 82 "Unbalance Force").

Conclusion – Action made Final

55. Applicant's amendment and Applicant's submission of an information disclosure statement under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p) on 10/22/2002 (paper # 9) and 4/8/2003 (paper # 13) necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a) and § 609(B)(2)(i). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

56. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

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will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

57. This Office action has an attached requirement for information under 37 CFR

1.105. A complete reply to this Office action must include a complete reply to the attached requirement for information. The time period for reply to the attached requirement coincides with the time period for reply to this Office action.

58. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Hugh Jones whose telephone number is (703) 305-0023. The examiner can normally be reached on Monday through Thursday.

59. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on (703) 305-9704. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

60. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-3900.

Hugh Jones Ph. D.

Primary Patent Examiner

January 15, 2003


HUGH JONES Ph.D.
PRIMARY PATENT EXAMINER
TECHNOLOGY CENTER 2100